

REMARKS/ARGUMENTS

Rejections under U.S.C. 35

All previous claims (1-23) have been canceled and new claims have been submitted.

New Claims

Applicants have submitted new claims 24-51. No new subject matter has been added. Support for the new claims can be found in the description of preferred embodiments in the specification and in the figures. Allowability of claims 24-51 will be explained in the remarks below.

New independent claim 24 claims a method for determining a pulse train pattern including a pulse whose level is set to a level corresponding to a level of a recording power set to be higher than a reproducing power and a pulse whose level is set to a level corresponding to a level of a bottom power set to be higher than the reproducing power and adapted for modulating the power of a laser beam used for recording data in a write-once type optical recording medium. The method comprises varying the level of the bottom power while fixing the recording power at a predetermined level, modulating the power of the laser beam in accordance with the pulse train patterns to record first test signals in the write-once type optical recording medium, reproducing the first test signals, determining the optimum level of the bottom power based on the thus reproduced first test signals, varying the level of the recording power while fixing the bottom power at the optimum level, modulating the power of the laser beam in accordance with the pulse train patterns to record second test signals in the optical recording medium, reproducing the second test signals, and determining the optimum level of the recording power based on the thus reproduced second test signals.

The above method is used to determine the optimum recording power and the optimum bottom power to be used in a pulse train to record data. As described in the specification, a feature of the present invention lies in that an optimum level of the bottom power of a laser beam is first determined by fixing the level of the recording power at a predetermined

level and recording first test signals while varying the level of the bottom power. The test signals are then reproduced and the optimum bottom power is selected based on the reproduced signals. The optimum recording power is then determined based on second test signals made using the previously discovered optimum bottom power while varying the recording power.

The prior art cited by the examiner does not show any method or combination of methods that discloses the method of claim 24. Lee et al. (US 6,404,712) shows that an optimum recording power may be determined and recorded in a recording medium but does not disclose a method for determining the optimum bottom power and the optimum recording power. Koichi et al. (US 6,611,481 B1) shows that when an amount of heat is insufficient for making marks, the duty cycle or the bottom power of the laser may be increased. Koichi does not disclose a method for finding the optimum recording power and the optimum bottom power. Finkelstein et al. (US 5,185,733) shows that a laser power corresponding to maximum amplitude of reproduced signal will be used. Finkelstein likewise does not disclose a method for determining the optimum bottom power and the optimum recording power.

Thus the prior art not only fails to disclose a method which distinctly determines both an optimum bottom power and an optimum recording power, but the prior art further fails to disclose the unique steps of first determining the optimum bottom power by recording first test signals while holding the recording power fixed, then determining the optimum recording power based on the optimum bottom power by recording second test signals while fixing the bottom power at the optimum level and varying the recording power.

New independent claim 24 thus is not anticipated by any reference, nor is it obvious under any combination of references. Claim 24 is thus believed to be allowable.

New dependent claim 25 claims the method of claim 4 wherein the optimum level of the bottom power of the laser beam is determined by varying the level of the recording power while fixing the level of the bottom power at a level substantially equal to the level of the reproducing power. The power of the laser beam is then modulated in accordance with the pulse train patterns to record third test signals in the write-once type optical recording medium. The third test signals are then reproduced, tentatively determining the optimum level of the recording power based on the thus reproduced third test signals. The level of the bottom power is then

varied while fixing the recording power at the tentatively determined optimum level and the power of the laser beam is modulated in accordance with the pulse train patterns to record first test signals in the write-once type optical recording medium. The first test signals are then reproduced, determining the optimum level of the bottom power based on the thus reproduced first test signals.

Thus in the case of claim 25, the level of the fixed recording power used in recording first test signals is pre-determined as a tentative optimum recording power. The tentative optimum recording power is found by recording third test signals with the bottom power fixed near the reproducing power while the recording power is varied.

New claim 26 claims the method of claim 25 wherein the optimum level of the bottom power is determined based on amplitudes of the reproduced first test signals.

New claim 27 claims the method of claim 26 wherein the optimum level of the bottom power is determined as a level of the bottom power when the amplitude of the reproduced first test signal becomes maximum.

New claim 28 claims the method of claim 25 wherein the optimum level of the recording power is tentatively determined based on at least one of jitter and error rates of the reproduced second test signals.

New claim 29 claims the method of claim 25 wherein the optimum level of the recording power is determined based on at least one of jitter and error rates of the reproduced second test signals.

New claim 30 claims the method of claim 25 wherein the optical recording medium comprises a light transmission layer, and a first recording layer and a second recording layer formed between the substrate and the light transmission layer, and is constituted so that the at least two recording marks are formed by projecting the laser beam thereonto, thereby mixing an element contained in the first recording layer as a primary component and an element contained in the second recording layer as a primary component.

New claim 31 claims the method of claim 25 wherein data are recorded in the optical recording medium by projecting a laser beam having a wavelength equal to or shorter than 450 nm thereonto.

New claim 32 claims the method of claim 25 wherein data are recorded in the optical recording medium by employing an objective lens and a laser beam whose numerical aperture NA and wavelength  $\lambda$  satisfy  $\lambda/NA \leq 640$  nm, and projecting the laser beam onto the optical recording medium via the objective lens.

New claim 33 claims the method of claim 24 wherein the optimum level of the bottom power is determined based on amplitudes of the reproduced first test signals.

New claim 34 claims the method of claim 24 wherein the optimum level of the bottom power is determined as a level of the bottom power when the amplitude of the reproduced first test signal becomes maximum.

New claim 35 claims the method of claim 24 wherein the optimum level of the recording power is determined based on at least one of jitter and error rates of the reproduced second test signals.

New claim 36 claims the method of claim 24 wherein the optical recording medium comprises a light transmission layer, and a first recording layer and a second recording layer formed between the substrate and the light transmission layer, and is constituted so that the at least two recording marks are formed by projecting the laser beam thereonto, thereby mixing an element contained in the first recording layer as a primary component and an element contained in the second recording layer as a primary component.

New claim 37 claims the method of claim 24 wherein data are recorded in the optical recording medium by projecting a laser beam having a wavelength equal to or shorter than 450 nm thereonto.

New claim 38 claims the method of claim 24 wherein data are recorded in the optical recording medium by employing an objective lens and a laser beam whose numerical aperture NA and wavelength  $\lambda$  satisfy  $\lambda/NA \leq 640$  nm, and projecting the laser beam onto the optical recording medium via the objective lens.

As dependent claims 25-38 depend from a claim believed to be allowable and contain the unique features thereof, claims 25-38 are also believed to be allowable.

New independent claim 39 claims an apparatus for recording data in a write-once type optical recording medium comprising laser beam power modulation pattern determining

means for determining a pulse train pattern and for modulating the power of a laser beam used for recording data in the write-once type optical recording medium. The pulse train pattern includes a pulse whose level is set to a level corresponding to a level of a recording power set to be higher than a reproducing power and a pulse whose level is set to a level corresponding to a level of a bottom power set to be higher than the reproducing power. The laser beam power modulation pattern determining means are constituted so as to vary the level of the bottom power while fixing the recording power at a predetermined level, modulate the power of the laser beam in accordance with the pulse train patterns to record first test signals in the write-once type optical recording medium, and reproduce the first test signals. The laser beam power modulation pattern determining means are further constituted so as to determine the optimum level of the bottom power based on amplitudes of the thus reproduced first test signals, vary the level of the recording power while fixing the bottom power at the optimum level, modulate the power of the laser beam in accordance with the pulse train patterns to record second test signals in the optical recording medium, and reproduce the second test signals and determine the optimum level of the recording power based on at least one of jitter and error rates of the thus reproduced second test signals.

The above apparatus comprises laser beam power modulation pattern determining means which are configured to determine a pulse train pattern that includes a bottom power and a recording power. As described in the specification, an important feature of the present invention lies in that an optimum level of the bottom power of a laser beam is first determined by fixing the level of the recording power at a predetermined level and recording first test signals while varying the level of the bottom power. The test signals are then reproduced and the optimum bottom power is selected based on the reproduced signals. The optimum recording power is then determined based on second test signals made using the previously discovered optimum bottom power while varying the recording power. Thus there is an important step of determining the optimum recording power based on a previously determined optimum bottom power. The apparatus is configured to perform the above functions.

The prior art cited by the examiner does not disclose any such apparatus or combination of apparatuses configured to perform these functions. Lee et al. (US 6,404,712)

shows that an optimum recording power may be determined and recorded in a recording medium but does not disclose an apparatus for determining the optimum bottom power and the optimum recording power. Koichi et al. (US 6,611,481 B1) shows that when an amount of heat is insufficient for making marks, the duty cycle or the bottom power of the laser may be increased. Koichi does not disclose an apparatus for finding the optimum recording power and the optimum bottom power. Finkelstein et al. (US 5,185,733) shows that a laser power corresponding to maximum amplitude of reproduced signal may be used. Finkelstein likewise does not disclose an apparatus for determining the optimum bottom power and the optimum recording power.

Thus the prior art not only fails to disclose an apparatus with means configured to distinctly determine both an optimum bottom power and an optimum recording power, but the prior art further fails to disclose an apparatus configured to perform the unique and important steps of first determining the optimum bottom power by recording first test signals while holding the recording power fixed, then determining the optimum recording power based on the optimum bottom power by recording second test signals while fixing the bottom power at the optimum level and varying the recording power. Furthermore no prior art shows an apparatus comprising means to determine the optimum bottom power based on the amplitude of reproduced first test signals and to determine the optimum recording power based on jitter or error rates in reproduced second test signals, all in addition to performing the above mentioned functions.

The above apparatus of claim 39 is therefore not anticipated by any prior art, nor is it obvious under any combination of prior art. Independent claim 39 is therefore believed to be allowable.

New claim 40 claims the apparatus of claim 39 wherein the laser beam power modulation pattern determining means is constituted so as to determine the optimum level of the bottom power of the laser beam by varying the level of the recording power while fixing the level of the bottom power at a level substantially equal to the level of the reproducing power. The laser beam power modulation pattern determining means is further configured for modulating the power of the laser beam in accordance with the pulse train patterns to record third test signals in the write-once type optical recording medium, reproducing the third test signals, tentatively determining the optimum level of the recording power based on the thus reproduced

third test signals, fixing the recording power at the tentatively determined optimum level and varying the level of the bottom power, modulating the power of the laser beam in accordance with the pulse train patterns to record first test signals in the write-once type optical recording medium, reproducing the first test signals, determining the optimum level of the bottom power based on at least one of jitter, amplitude, and error rates of the thus reproduced first test signals.

New claim 41 claims the apparatus of claim 40 wherein the optimum level of the bottom power is determined based on amplitudes of the reproduced first test signals.

New claim 42 claims the apparatus of claim 39 wherein the optimum level of the bottom power is determined based on amplitudes of the reproduced first test signals.

As claims 40-42 depend from an independent claim which is believed to be allowable and have the unique features thereof, claims 40-42 are also believed to be allowable.

New independent claim 43 claims a write-once type optical recording medium comprising a substrate and at least one recording layer disposed on the substrate and being constituted so that data are recorded by projecting a laser beam whose power is modulated in accordance with a pulse train pattern including at pulses whose levels are set to levels corresponding to a recording power and a bottom power onto the at least one recording layer to form a recording mark in the at least one recording layer. The write-once type optical recording medium is recorded with modulation pattern setting data for setting a pulse train pattern used for modulating a power of the laser beam. The modulation pattern setting data are produced by determining pulse train patterns by varying the level of the bottom power while fixing the recording power at a predetermined level, modulating the power of the laser beam in accordance with the pulse train patterns to record first test signals in the write-once type optical recording medium, reproducing the first test signals, determining the optimum level of the bottom power based on the thus reproduced first test signals, varying the level of the recording power while fixing the bottom power at the optimum level, modulating the power of the laser beam in accordance with the pulse train patterns to record second test signals in the optical recording medium, reproducing the second test signals and determining the optimum level of the recording power based on the thus reproduced second test signals.

The above optical recording medium has data recorded therein for setting the pulse train pattern used for modulating the laser beam. This data is obtained by the method of claim 24. As discussed above, no prior art or combination of prior art discloses this method. Therefore there is no prior art which discloses an optical recording medium with pulse train pattern data recorded thereon and obtained by the above method. Therefore new independent claim 43 is believed to be allowable.

New claim 44 claims the optical recording medium of claim 43 wherein the modulation pattern setting data are produced by determining pulse train patterns by varying the level of the recording power while fixing the level of the bottom power at a level substantially equal to the level of the reproducing power, modulating the power of the laser beam in accordance with the pulse train patterns to record third test signals in the write-once type optical recording medium, reproducing the third test signals, tentatively determining the optimum level of the recording power based on the thus reproduced third test signals, varying the level of the bottom power while fixing the recording power at the tentatively determined optimum level, modulating the power of the laser beam in accordance with the pulse train patterns to record first test signals in the write-once type optical recording medium, reproducing the first test signals, determining the optimum level of the bottom power based on the thus reproduced first test signals.

New claim 45 claims the optical recording medium of claim 44 wherein the modulation pattern setting data are produced by determining the optimum level of the bottom power as a level of the bottom power when the amplitude of the reproduced first test signal becomes maximum.

New claim 46 claims the optical recording medium of claim 44 wherein the modulation pattern setting data are produced by determining the optimum level of the recording power based on at least one of jitter and error rates of the reproduced second test signals.

New claim 47 claims the optical recording medium of claim 44 wherein the modulation pattern setting data are produced by tentatively determining the optimum level of the recording power based on at least one of jitter and error rates of the reproduced second test signals.

New claim 48 claims the optical recording medium of claim 44 comprising a light transmission layer, and a first recording layer and a second recording layer formed between the substrate and the light transmission layer, and is constituted so that the at least two recording marks are formed by projecting the laser beam thereonto, thereby mixing an element contained in the first recording layer as a primary component and an element contained in the second recording layer as a primary component.

New claim 49 claims the optical recording medium of claim 43 wherein the modulation pattern setting data are produced by determining the optimum level of the bottom power as a level of the bottom power when the amplitude of the reproduced first test signal becomes maximum.

New claim 50 claims the optical recording medium of claim 43 wherein the modulation pattern setting data are produced by determining the optimum level of the recording power based on at least one of jitter and error rates of the reproduced second test signals.

New claim 51 claims the optical recording medium of claim 43 which further comprises a light transmission layer, and a first recording layer and a second recording layer formed between the substrate and the light transmission layer. The recording medium is constituted so that recording marks are formed by projecting the laser beam thereonto, thereby mixing an element contained in the first recording layer as a primary component and an element contained in the second recording layer as a primary component.

As claims 44-51 depend from a claim believed to be allowable and contain the unique features thereof, claims 44-51 are believed to be allowable.

### Conclusions

In light of the above amendments and remarks, Applicants respectfully submit that all pending claims are allowable. Therefore, Applicants respectfully request that the Examiner reconsider this application and allow all pending claims. Examiner Jones is encouraged to contact the undersigned by telephone to discuss the above distinctions between the claims and the applied references, if desired, or informalities in the claims, if any.

Application No. 10/516,701  
Reply to Office Action dated March 22, 2006

The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

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